PROJECT PHASE 1 REPORT

ON

GALERIUS

Submitted by

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to

the APJ Abdul Kalam Technological University

in partial fulfillment of the requirements for the award of the degree

of

Bachelor of Technology

in

Computer Science and Engineering

Department of Computer Science and Engineering
St. Joseph's College of Engineering and Technology, Palai

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Declaration

We undersigned hereby declare that the project report on **"Galerius"**, submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala, is a bonafide work done by us under supervision of **Prof. Mereen Thomas**. This submission represents our ideas in our own words and where ideas or words of others have been included, We have adequately and accurately cited and referenced the original sources. We also declare that we have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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CERTIFICATE

This is to certify that the report entitled "**GALERIUS**" submitted by **AIMIL BIJ JOSEPH (SJC20CS007), ALEN EMMANUEL (SJC20CS017), ALLEN ALEX ALANEY (SJC20CS019), PRANAV P (SJC20CS098)** to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering is a bonafide record of the project work carried out by them under my guidance and supervision.

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Acknowledgement

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Abstract

Galerius is a game development project that seeks to immerse players in the grandeur of ancient Rome. The project is defined by the strategic use of multimedia tools, with Blender serving as the primary asset creation platform for meticulously crafting 3D models, textures, and animations with a focus on historical accuracy. Unreal Engine is chosen for its robust capabilities, seamlessly integrating these Roman-themed assets to construct a dynamic virtual world that authentically captures the essence of ancient Roman landscapes and architecture. Unreal Engine 5 elevates the gaming experience by providing advanced audio features, enabling the creation of a cinematic and emotionally resonant auditory journey. The project also utilizes Audacity for precise sound editing, contributing to the immersive audio narrative that complements the grandeur of ancient Rome. "Galerius" aims to deliver a visually stunning and historically accurate Roman-themed game, showcasing the synergy between multimedia tools and game development to create an epic adventure for players.

Contents

Contents

List of Figures

Chapter 1

Introduction

Step into the captivating world of Galerius a game development project poised to transport players to the lives of ancient Rome. Central to our creative vision is Blender, a versatile tool meticulously employed to craft historically accurate 3D models, textures, and animations, laying the visual groundwork for an immersive Roman experience.The seamless integration of these assets is facilitated by Unreal Engine 5, renowned for its versatility in constructing dynamic virtual worlds that authentically capture the grandeur of Rome.

Unreal Engine 5 introduces an auditory dimension to our project, leveraging advanced audio features to create a cinematic soundscape. From the ambient sounds of Roman cities to the resonance of epic battles, every auditory element is carefully curated to immerse players in the atmospheric richness of ancient Rome. Precise sound editing with Audacity further refines these elements, contributing to an audio narrative that complements the visual spectacle.

"Galerius" stands as more than a game; it's an exploration of the harmonious collaboration between multimedia tools and game development. As we navigate this creative odyssey, documenting our challenges and triumphs, we invite you to witness the synthesis of historical accuracy and cutting-edge technology, shaping an epic adventure that transcends the confines of virtual reality.

1.1 Background

In the realm of game development, crafting a captivating background is pivotal to immerse players in a compelling experience. Begin by delineating the fundamental game concept, clarifying the genre and outlining core gameplay mechanics. Establish a vibrant game world by defining its setting, incorporating unique features, and formulating the rules that govern this virtual domain. Characters are the soul of any game; create in-depth profiles for main characters, delving into their backstories, motivations, and relationships. Non-player characters (NPCs) should also be carefully considered, as they contribute to the richness of the game world.

With the stage set, it's time to weave a narrative that captivates players. Develop a storyline with a three-act structure, introducing players to the world, building tension through conflicts, and providing satisfying resolutions. The lore and backstory of the game world should be meticulously crafted, incorporating historical events, cultures, and mythologies to enrich the player's understanding of the environment. Visualization is paramount in game development, so define the visual style and art direction, ensuring they align with the narrative to enhance player immersion. Concurrently, a carefully curated soundtrack and sound effects contribute to the game's atmosphere, complementing the visual elements to create a holistic experience. Through iterative playtesting, refine game mechanics, narrative elements, and visual/audio components based on player feedback, ensuring a cohesive and engaging background for a truly immersive gaming adventure.

1.2 Objective and Scope

Game development is driven by a multifaceted set of objectives, foremost among them being the provision of entertainment. The industry seeks to engage players through enjoyable and immersive experiences, employing innovative and creative concepts that push the boundaries of technology. A pivotal objective involves crafting compelling narratives and storytelling, fostering emotional connections between players and virtual worlds. Technical excellence is also a prime goal, with developers striving to achieve high-quality

graphics, smooth gameplay, and cutting-edge use of technology. Community building, monetization, and player engagement round out the overarching goals, as games evolve into dynamic and social experiences.

The scope of game development is expansive, encompassing diverse platforms such as consoles, PCs, mobile devices, virtual reality, and augmented reality. Developers navigate various genres and styles, incorporating art, design, and programming to create visually appealing and technically sophisticated games. The scope extends to the realms of sound and music, with audio elements playing a crucial role in enhancing the gaming experience. Rigorous testing and quality assurance are integral to the process, ensuring a polished and bug-free final product. Post-launch support further extends the scope, as developers provide ongoing updates, support, and potential expansions to maintain player engagement in an ever-evolving gaming landscape. Understanding the intricate objectives and broad scope of game development is paramount for industry professionals aiming to deliver successful and enduring gaming experiences.

Chapter 2

Literature Review

2.1 Development and Optimization

In the dynamic realm of contemporary game development, the integration of powerful tools is imperative for crafting visually captivating and immersive gaming experiences. This report explores the synergies between two robust software packages, Unreal Engine and Blender, and elucidates their collective impact on the game development process.

Unreal Engine stands out for its cutting-edge graphics, rendering prowess, and advanced lighting features, providing developers with a platform to create visually stunning games. The Blueprint visual scripting system simplifies gameplay logic, fostering rapid proto-typing without extensive coding [5]. Asset management capabilities, including a content browser, facilitate the organization and importation of 3D models and textures. Unreal Engine's animation system, physics engine, and VR support further bolster its standing as a comprehensive game development engine.

On the other hand, Blender, a versatile open-source 3D content creation suite, excels in 3D modeling and animation [1]. It offers a suite of tools for sculpting, rigging, and simulation. Blender's UV mapping and node-based material system enable intricate texturing and shading. Its video editing and compositing features, including the Video Sequence Editor (VSE), enhance rendered scenes with visual effects [3]. With support for character rigging

and the efficient Rigify add-on, Blender emerges as a robust tool for character animation.

The seamless integration of Unreal Engine and Blender introduces a harmonious work-flow in game development. Common file format support ensures smooth asset exchange, allowing for a collaborative approach between the modeling strengths of Blender and the advanced game development features of Unreal Engine [5]. This collaboration enhances the prototyping process, enables efficient animation transfer, and facilitates level design with assets created in Blender. Ultimately, this integrated approach positions developers to efficiently create visually impressive and immersive gaming experiences, meeting the demands of modern game development effectively.

Embarking on the journey from 2D to 3D modeling involves a profound transformation in the way artistic concepts are translated into visual creations [1]. This paradigm shift introduces a third dimension, adding depth and volume to designs, with the understanding of 3D space becoming fundamental, encompassing the introduction of the X, Y, and Z axes. This evolution is not merely a technical adjustment but a gateway to a more immersive and dynamic realm of creative expression.

Progressing from basic primitives to mesh modeling marks a significant advancement [3]. Artists refine their craft by manipulating vertices, edges, and faces, gradually constructing intricate forms and pushing the boundaries of their creative visions. This stage is charac-terized by a shift from predefined shapes to the sculpting of unique, bespoke 3D models. The exploration of lighting and rendering becomes paramount in the quest for realism [5]. Artists delve into the intricacies of illuminating the 3D space, experimenting with various lighting setups and configurations. Rendering becomes a transformative process, turning raw 3D models into realistic visualizations that capture the interplay of light and shadow.

2.2 Desirable Characteristics

Developing action games that cater to the preferences and needs of elderly individuals involves a thoughtful consideration of several key characteristics. First and foremost is the importance of cognitive stimulation. Action games designed for older adults should include

elements that stimulate problem-solving skills [9]. Incorporating challenges that engage the mind with strategic thinking not only provides entertainment but also contributes to maintaining cognitive function, promoting mental well-being among the elderly players.

In terms of user experience, the accessibility and user-friendly design play a crucial role. Intuitive controls are paramount, ensuring that the game mechanics are straightforward and easy to navigate [6]. This approach acknowledges the potential variations in technological familiarity among older players, enhancing inclusivity and making the gaming experience more enjoyable.

Maintaining a moderate pace and reducing overall complexity are additional considerations. Many older adults may prefer action games with a moderate pace, avoiding overwhelming speeds that could be challenging to follow [9]. Similarly, reducing complexity in terms of rules and objectives helps create a gaming environment that is more accommodating and enjoyable for this demographic.

Incorporating elements of physical activity is another desirable characteristic for action games targeting older adults. Games that encourage mild physical engagement, such as simple gestures or light exercise, not only add an interactive dimension but also promote health and well-being [9].

A meaningful narrative is also crucial in capturing the interest of older players. Action games that incorporate compelling storylines with themes that resonate with their life experiences can enhance the overall gaming experience [6]. This approach adds depth to the gameplay and fosters a more immersive connection with the virtual world.

Social interaction features are essential for creating a more engaging gaming experience. Including multiplayer options allows older adults to connect with friends or family members, fostering a sense of camaraderie through cooperative gameplay or friendly competitions [9]. This social aspect contributes significantly to the appeal of action games among the elderly.

Clear feedback and progression markers are vital for maintaining motivation [9]. Action games should provide visible indicators of accomplishments and progression, offering pos-

itive reinforcement to players. This not only boosts morale but also encourages continued engagement with the game.

Customization options add a layer of personalization to the gaming experience. Allowing players to tailor settings such as difficulty levels and control preferences ensures that the game caters to individual preferences and skill levels, promoting a more enjoyable and adaptable experience [6].

Positive visuals and aesthetics are crucial considerations in game design for older adults. Games with clear, well-defined visuals and an aesthetically pleasing design contribute to a comfortable and visually appealing gaming environment. Avoiding overly intense or busy graphics ensures that the visual experience remains enjoyable and easy on the eyes.

Finally, encouraging learning through user-friendly tutorials is essential [7]. Action games should incorporate tutorials that guide players through game mechanics, providing a learning curve that contributes to a sense of accomplishment and mastery over time. By considering and integrating these characteristics, game developers can create action games that are not only entertaining but also inclusive and beneficial for the well-being of older players.

2.3 Case Study on Gear Of Wars

Developing an action game within Unreal Engine is a meticulous process that involves a series of well-defined steps, resulting in a visually stunning and engaging gaming experience. A standout example of such a creation is "Gears of War," developed by The Coalition [8]. The journey begins with conceptualization and planning, where the game's genre, theme, and core mechanics are defined. A detailed design document outlines features, mechanics, and technical requirements, providing a roadmap for development. Concept art and storyboards help visualize the game's aesthetics and structure, contributing to pre-production efforts.

Learning the basics of Unreal Engine is a foundational step, ensuring developers are

acquainted with the engine's interface, tools, and scripting systems [2]. This knowledge is crucial for the subsequent stages of asset creation, where 3D models, animations, and textures are developed, and level design is implemented using Unreal Engine's powerful level editor. The game's logic and mechanics are then brought to life through Blueprint visual scripting or C++, incorporating features unique to the action genre, such as combat systems and enemy AI.

Sound design is integral, enhancing the gaming experience with carefully integrated sound effects, background music, and voiceovers. The testing and iteration phase follow, where the game is regularly playtested, and feedback is collected for continuous improvement. Optimization ensures the game runs smoothly on various platforms, addressing performance bottlenecks and optimizing assets. Polishing involves refining visuals, animations, and gameplay elements, while the implementation of UI and HUD elements enhances player interaction.

Transitioning to the distribution phase, the game is prepared for release on chosen platforms, adhering to platform-specific guidelines. The launch is a crucial moment, and post-launch support includes addressing player feedback, providing updates, and ensuring a stable gaming experience. This comprehensive approach is a testament to Unreal Engine's capabilities in facilitating the development of intricate action games that not only meet but exceed player expectations.

In the context of "Gears of War," the Unreal Engine's prowess is evident in the game's breathtaking graphics, seamless animations, and dynamic lighting effects [8]. The game seamlessly integrates intense action sequences with a compelling narrative, balancing adrenaline-pumping combat with a rich storytelling experience. The Unreal Engine's capabilities shine through in the game's fluid animations, responsive controls, and the seamless transition between action-packed set pieces. "Gears of War" serves as a prime example of how the Unreal Engine can bring visually stunning and engaging action games to life, captivating players with both aesthetic appeal and adrenaline-fueled gameplay. The collaborative efforts of developers within the Unreal Engine ecosystem result in a meticulously crafted and immersive gaming experience for players.

Chapter 3

Requirement Analysis

3.1 Existing solutions

The gaming industry has recognized the importance of creating video games that cater to the preferences and needs of elderly players. While the landscape is continually evolving, several existing games have gained popularity among this demographic. Games such as "A Short Hike" provide a relaxing and exploratory experience, while the Wii Sports series, known for its intuitive motion controls, remains a classic choice for physical activity. "Animal Crossing: New Horizons" and the "Sims" series offer open-ended, creative gameplay, appealing to a broad audience, including older players.

Puzzle games like "Bejeweled" and "Hidden Folks" provide cognitive engagement in a relaxed setting, and the visually stunning "Monument Valley" series offers a contemplative puzzle-adventure experience. "Gardenscapes" combines match-3 puzzles with a gardening theme, while classics like "Solitaire" and popular mobile games like "Candy Crush Saga" maintain their appeal across age groups.

However, the need for new games in this area remains significant. As the elderly population engages more with video games, developers have an opportunity to create tailored experiences that address specific aspects important to older players. These aspects may include further emphasis on cognitive stimulation, user-friendly interfaces, and games that

promote social interaction. New titles can explore innovative ways to incorporate physical activity, diverse storytelling, and customizable gameplay settings to cater to a wide range of abilities and preferences within the older demographic.

Creating a variety of games that consider the diverse interests and needs of elderly players is crucial. Whether through immersive narratives, accessible controls, or unique gameplay mechanics, new games have the potential to contribute to the well-being and enjoyment of older individuals engaging in the gaming world. Additionally, ongoing advancements in gaming technology present opportunities for the development of innovative and inclusive gaming experiences that go beyond the current offerings, providing a more enriching and diverse gaming landscape for the elderly audience.

3.2 Non-Functional Requirements

3.2.1 Usability

Our top priority in designing the game interface is to make it user-friendly, ensuring that players can easily navigate through menus and interact with the game elements. We're placing a strong emphasis on accessibility, ensuring that the interface is inclusive and can be comfortably used by players with different abilities. This involves incorporating features like adjustable text sizes, color schemes for better visibility, and intuitive controls to enhance the overall gaming experience.

3.2.2 Performance

We are committed to delivering a seamless gaming experience by focusing on performance. This means optimizing the game for fast response times and high frame rates, providing players with smooth and immersive gameplay. By efficiently managing system resources and employing optimization techniques, we aim to eliminate lag or delays, contributing to a more enjoyable gaming environment.

3.2.3 Security

To safeguard player data and maintain the integrity of the game, robust security measures are being implemented. This includes encryption protocols, secure authentication processes, and regular security audits. By prioritizing security, we aim to protect against potential data breaches and create a trustworthy environment for our players.

3.2.4 Compatibility

Our game is being developed with compatibility in mind, ensuring it runs seamlessly across various platforms and operating systems. Whether players are on PC, console, or mobile devices, we want to provide a consistent and enjoyable gaming experience for everyone. This involves thorough testing and optimization to address any platform-specific challenges and ensure broad accessibility.

3.2.5 Maintainability

In order to facilitate future updates and address any bugs that may arise, we are placing a strong emphasis on maintainability. This involves writing clean and organized code, documenting processes, and efficiently managing game assets. By establishing a solid foundation for maintenance, we aim to streamline the development process for future updates, ensuring a continued and improved gaming experience for our players.

3.3 Functional Requirements

3.3.1 Game Mechanics

The core gameplay mechanics serve as the building blocks of our game, defining how players interact with the virtual world. This includes aspects like how characters move, engage in combat, and utilize special abilities. We're focusing on creating intuitive and

responsive mechanics to ensure that players can easily navigate, fight, and use unique skills within the game environment.

3.3.2 Story and Narrative

The storyline and narrative elements of our game are crucial for engaging players and providing a rich gaming experience. We're crafting a compelling narrative that unfolds through dialogues and in-game events, creating an immersive world for players to explore. This involves carefully planning the plot, character development, and the overall storytelling approach to keep players captivated throughout their gaming journey.

3.3.3 User Interface (UI)

Designing the user interface involves creating in-game menus, the Heads-Up Display (HUD), and other elements that players interact with. Our focus is on designing a clean and user-friendly UI to enhance the overall gaming experience. This includes making sure menus are easy to navigate, information is presented clearly, and players can intuitively access the features they need during gameplay.

3.3.4 Items and Inventory

Describing the items, equipment, and inventory systems helps players manage their in-game possessions. We're developing a system that allows players to collect items, acquire equipment, and organize their inventory efficiently. This adds depth to the gameplay by providing players with choices on how to approach challenges and customize their gaming experience.

3.3.5   Performance Optimization

To ensure our game runs smoothly on a variety of hardware configurations, we're implementing performance optimization features. This includes graphics settings and options that players can adjust to optimize the game's performance based on their computer or gaming device. By offering these customization options, we aim to provide an enjoyable gaming experience for players with different hardware capabilities.

3.4   Hardware Requirements

3.4.1   For Developers

For our game development, we've identified two recommended processor options: the Core i5 and i7. These processors, developed by Intel, are known for their power and efficiency in handling the computational demands of modern games. By selecting the Core i5 and i7, we aim to ensure that our game runs smoothly and delivers an optimal performance experience for players.

In terms of memory, we're targeting a system with 16GB of RAM. RAM, or Random Access Memory, is crucial for storing and quickly accessing data that the game needs to run. With 16GB of RAM, we're providing enough memory for the game to operate efficiently, reducing load times and potential lag, and ensuring a responsive gaming experience for players.

For graphics processing, our game is designed to work well with two specific GPU options: the 1650 with 4GB of RAM and the 2050 with 4GB of RAM. These graphics processing units, or GPUs, are responsible for rendering the visuals in the game. By supporting these GPUs, we're aiming to deliver quality graphics and smooth gameplay, even on systems with moderate graphics capabilities.

3.4.2   For Game Play

Our game development project is geared towards a diverse range of players, accommodating various hardware configurations to ensure a broad accessibility. We've identified three processor options for players: Core i3, i5, and i7. These Intel processors cater to different levels of computing power, allowing our game to run smoothly across a spectrum of gaming systems. Whether players have a more budget-friendly Core i3 or a high-performance i7, we aim to provide an enjoyable gaming experience.

In terms of memory, our game is designed to work seamlessly with systems featuring either 8GB or 16GB of RAM. This flexibility allows players with different hardware setups to enjoy our game without compromising on performance. The RAM, or Random Access Memory, is vital for smooth operation, and by supporting both 8GB and 16GB configurations, we prioritize inclusivity.

Our game is also optimized to run on GPUs with varying capabilities. We've considered the GTX 650 with 1GB of RAM and the Radeon 550 with 1GB of RAM. These graphics processing units play a crucial role in rendering the game's visuals. By supporting GPUs with different performance levels, we're ensuring that players can enjoy our game regardless of their graphics card specifications.

3.5   Technology Stack

3.5.1   Blender 3.6

In our project, we harnessed the power of Blender 3.6, the latest version of this versatile open-source 3D software. This updated version introduced notable features such as enhanced real-time rendering capabilities and improved fluid simulation. These features proved instrumental in elevating our project's visual appeal, providing advanced tools for modeling, animation, and rendering. Blender 3.6's collaborative features and seamless compatibility further streamlined our workflow, playing a key role in the overall success

of our game development endeavor.

3.5.2 Unreal Engine 5

In our project, we harnessed the capabilities of Unreal Engine, incorporating the user-friendly Blueprint Visual Scripting for efficient game logic creation, even for non-programmers. The Animation System facilitated the development of lifelike character movements and cinematic sequences with features like Inverse Kinematics and dynamic animation blending. Additionally, the engine's comprehensive audio tools allowed us to craft immersive soundscapes, utilizing spatial audio, interactive responses, and built-in effects like reverb. These Unreal Engine features collectively played a vital role in enhancing the overall quality and depth of our project.

3.5.3 Figma

In our project, Figma proved instrumental in streamlining the design process through its robust User Interface (UI) tools, facilitating efficient asset creation and management. The platform's collaborative features enabled seamless teamwork, allowing designers to work concurrently on UI elements. Figma's animation and interaction design capabilities empowered us to prototype and visualize dynamic user experiences, enhancing the overall interactivity of our project. The platform's versatility in UI design, asset management, and animation functionalities played a pivotal role in achieving a cohesive and visually engaging user interface for our project.

3.5.4 C++

In our project, we seamlessly integrated C++ with game engines, leveraging its robust capabilities for efficient development. This integration allowed us to create a cross-platform experience, ensuring compatibility across various operating systems and devices. Harnessing the power of C++ facilitated the implementation of precise controls, enhancing

user interaction and gameplay. The combination of C++ integration with game engines and a cross-platform approach was crucial in achieving a versatile and accessible gaming experience for our project.

Chapter 4

System Study

4.1 Modules

The system is divided into five modules :

(1) Game Design

(2) Graphics and Animation

(3) Sound Design

(4) Game UI Interface Design

(5) Programming

4.1.1 Game Design

This module offers a comprehensive exploration of the essential principles underlying successful game design. Participants will immerse themselves in the interdisciplinary nature of this field, weaving together elements of art, technology, psychology, and narrative to shape captivating virtual worlds. Through a blend of theoretical concepts and practical applications, students will gain a holistic understanding of the intricate dynamics involved in creating engaging and interactive gaming experiences.

The curriculum covers core principles such as player engagement, balance, progression,

and feedback. Through the analysis of case studies, participants will discern effective design elements and mechanics employed in popular games. The module delves into the mechanics driving gameplay, addressing rules, objectives, challenges, and rewards. Students will have the opportunity to design and prototype basic game systems, honing their ability to consider the impact on player experience.

Narrative design takes center stage, exploring the pivotal role of storytelling in games and its influence on player immersion. Techniques for crafting compelling storylines and seamlessly integrating narrative into gameplay will be a focal point. The significance of user experience (UX) design in gaming will be explored, emphasizing interface design, player control, and accessibility. Playtesting and user feedback will be integral to refining and enhancing the overall user experience.

Visual and audio elements in game design will be scrutinized, encompassing graphics, animation, sound effects, and music. Participants will understand how aesthetics contribute to the atmosphere and emotional impact of a game. The module will also cultivate practical skills in prototyping, encouraging an iterative design approach. Students will learn the importance of refining game designs based on playtesting and user feedback.

The exploration extends to emerging technologies in game design, encompassing virtual reality, augmented reality, and artificial intelligence. Participants will consider how these technologies can be harnessed to elevate game design. Ethical considerations, including representation, inclusivity, and the societal impact of games, will be discussed. Cultural influences on game design and the imperative of diverse perspectives in creating inclusive gaming experiences will be highlighted.

By the conclusion of this module, participants will possess a robust foundation in game design principles and practical skills. Equipped with both theoretical knowledge and hands-on experience, students will be well-prepared to navigate the dynamic landscape of game design, ready to contribute to the evolving and innovative aspects of the gaming industry.

When registering a blood bank, basic details like name and contact details have to be given and certification details needs to be produced to verify the blood bank. Blood banks needs

to mention whether there is a hospital integrated with them or not. Particulars of blood available in the blood bank is also collected during the registration procedure. Blood banks must also provide their location information.

When a requestor registers his blood requirement in the portal, he needs to provide necessary contact details. The requestor also needs to provide valid doctor certificate to prove the legitimacy of the request. This verification ensures that sensitive data about the donors are not disclosed to malicious users. Thereby ensuring privacy of the donors.

4.1.2 Graphics and Animation

This module provides an in-depth exploration into the dynamic realm of graphics and animation, focusing on the seamless integration of Unreal Engine 5 and Blender. Participants will embark on a comprehensive journey, gaining proficiency in creating visually stunning and immersive environments, characters, and animations.

The curriculum begins with an introduction to the fundamentals of computer graphics and the core principles of visual design. Participants will then delve into the intricacies of Unreal Engine 5, understanding its interface, tools, and key features. The module emphasizes the integration of Blender, a powerful open-source 3D content creation suite, as a complementary tool for asset creation.

Participants will explore the process of creating 3D models, textures, and animations using Blender, ensuring a solid foundation in asset creation. The module then seamlessly transitions into Unreal Engine 5, guiding students on importing, optimizing, and implementing these assets within the engine.

In-depth discussions on real-time rendering techniques, lighting, and material creation within Unreal Engine 5 will be central to the module. Participants will learn to harness the engine's capabilities to achieve stunning visual fidelity, ensuring a visually compelling and immersive gaming experience.

Animation principles, including rigging, skeletal animation, and character animation, will

be explored using both Blender and Unreal Engine 5's animation systems. The module will guide students through the process of creating lifelike character animations, integrating them seamlessly into the game environment.

The integration of visual effects (VFX) and particle systems within Unreal Engine 5 will be covered, allowing participants to add dynamic and interactive elements to their projects. Practical exercises and projects will provide hands-on experience in creating visually striking scenes, characters, and animations.

Throughout the module, an emphasis will be placed on the collaborative workflow between Blender and Unreal Engine 5. Participants will gain the skills necessary to iterate on designs, make adjustments, and optimize assets for real-time rendering.

By the conclusion of this module, participants will have acquired a comprehensive skill set in graphics and animation, mastering the tools and techniques required to create captivating visual experiences. Equipped with the ability to seamlessly integrate Blender assets into Unreal Engine 5, students will be well-prepared to contribute to the dynamic and visually-driven field of game development.

4.1.3 Sound Design

This module provides a thorough exploration of sound design within the context of game development, utilizing three powerful tools: Audacity, Unreal Engine 5, and Adobe Audition. Participants will gain comprehensive insights into creating, editing, and implementing audio assets to enhance the immersive quality of gaming experiences.

The curriculum begins with an introduction to the principles of sound design, covering topics such as audio theory, spatial audio, and the psychology of sound in gaming. Participants will then delve into the practical application of sound design using Audacity, a free, open-source audio software. This section will cover audio recording, editing, and manipulation, ensuring students have a strong foundation in crafting diverse and impactful soundscapes.

The module transitions to Unreal Engine 5, where participants will learn how to integrate sound assets seamlessly into the game environment. This includes understanding the engine's audio systems, implementing spatial audio techniques, and synchronizing sound with in-game events. Practical exercises will provide hands-on experience in creating immersive audio environments within the Unreal Engine.

Adobe Audition, a professional audio editing software, will be introduced to enhance the participants' skill set. This section will focus on advanced audio editing techniques, noise reduction, and the creation of complex sound effects and musical compositions. Students will also explore the integration of Adobe Audition with other tools in the game development pipeline.

The module emphasizes the collaborative workflow between Audacity, Unreal Engine 5, and Adobe Audition, ensuring participants can seamlessly transition between these tools to create a cohesive and compelling auditory experience in games. Topics such as dynamic audio, adaptive music systems, and dialogue implementation will be covered to enhance the depth of understanding.

Practical projects will challenge participants to create and implement soundscapes for various gaming scenarios, including ambient environments, character interactions, and dramatic events. The importance of iteration and playtesting in refining the audio experience will be highlighted throughout the module.

By the end of the module, participants will possess a well-rounded skill set in sound design, leveraging Audacity, Unreal Engine 5, and Adobe Audition. Equipped with the ability to create and integrate high-quality audio assets, students will contribute significantly to the immersive and engaging aspects of game development.

4.1.4   Game UI Interface Design

This module offers a comprehensive exploration of User Interface (UI) design, focusing on the practical application of design principles and the utilization of industry-standard tools such as Adobe XD and Figma. Participants will gain hands-on experience in creating

visually appealing and user-friendly interfaces for various digital platforms.

The curriculum begins with an introduction to the fundamental principles of UI design, covering topics such as user experience (UX), visual hierarchy, and accessibility. Participants will develop a solid understanding of how design decisions impact user interactions and overall usability.

The module then transitions to Adobe XD and Figma, two leading UI/UX design tools. Participants will learn the essential features of each tool, including artboards, components, and collaboration functionalities. Practical exercises will guide students in creating wireframes, prototypes, and high-fidelity designs, ensuring proficiency in translating design concepts into tangible interface layouts.

Design thinking methodologies will be integrated into the module, emphasizing user-centered design approaches. Participants will engage in user research, persona development, and iterative design processes to create interfaces that align with user needs and expectations.

Advanced topics such as responsive design, design systems, and interaction design will be explored, providing participants with a comprehensive skill set for designing interfaces that are not only visually appealing but also functional and intuitive across various devices.

The collaborative nature of UI design will be emphasized, with a focus on teamwork, feedback loops, and version control within Adobe XD and Figma. Participants will gain practical insights into real-world collaboration scenarios, simulating the collaborative environments common in professional design teams.

Throughout the module, industry best practices and emerging trends in UI design will be discussed, ensuring that participants are well-prepared to create interfaces that meet contemporary design standards. The importance of prototyping and user testing in refining and validating designs will be highlighted.

By the conclusion of this module, participants will have developed a strong foundation in UI design principles and practical skills in using Adobe XD and Figma. Equipped with the ability to create visually stunning and user-centric interfaces, students will be ready

to contribute to the design aspects of digital products and applications.

4.1.5   Programming

This module offers an immersive exploration into the dynamic synergy of programming with Unreal Engine 5 using the C++ programming language. Participants will embark on a comprehensive journey, gaining proficiency in harnessing the power of Unreal Engine 5 to create sophisticated and visually stunning interactive experiences.

The curriculum begins with a foundational understanding of the Unreal Engine 5 environment, providing an overview of the interface, tools, and key features. Students will then delve into the integration of C++ programming, learning how to leverage its capabilities for game development within the Unreal Engine framework.

Participants will explore core programming concepts, including variables, data types, control flow, and functions, all within the context of Unreal Engine 5. The module will guide students through the creation of gameplay mechanics, emphasizing the translation of conceptual game design into functional code.

In-depth discussions on object-oriented programming (OOP) principles will be central to the module, highlighting their relevance in designing scalable and maintainable game systems. Students will learn to create and manipulate game objects, implement inheritance and polymorphism, and manage memory effectively within the Unreal Engine environment.

The module places a strong emphasis on the Unreal Engine API and how it can be utilized to interact with various engine components. Participants will gain hands-on experience in scripting gameplay events, managing assets, and implementing custom features through C++.

Advanced topics such as multiplayer functionality, artificial intelligence (AI) programming, and optimization strategies will be explored, showcasing how C++ can be leveraged to create robust and efficient game systems. Throughout the module, students will engage

in practical exercises and projects, applying their programming skills to create functional game prototypes.

By the conclusion of this module, participants will have not only mastered the intricacies of C++ programming within Unreal Engine 5 but also developed a practical understanding of how to bring game concepts to life through coding. Armed with this knowledge, students will be well-equipped to navigate the complexities of game development, from crafting immersive gameplay mechanics to optimizing performance within the cutting-edge Unreal Engine 5 environment.

Chapter 5

System Design

5.1 Use Case Diagram

The use case diagram for game development encompasses the dynamic interactions between two primary actors: players and developers. Players, seeking entertainment and engagement, interact with the system through actions like 'Install and Download,' 'Start Game,' 'New/Restart Game,' 'Save and Load Game,' 'Guidance,' 'Complete Missions,' 'Upgrade Inventories,' and 'Win/Retry Game in Figure 5.1 These use cases encapsulate the diverse facets of the player experience, from initiating the game to progressing, upgrading, and concluding gameplay. On the other hand, developers engage with the system by triggering the 'Create Game,' 'Process/Maintain Game,' 'Publish Game,' and 'Exit' use cases. These actions span the entire game development lifecycle, from the initiation of a new project to ongoing maintenance, publication, and eventual closure. The relationships between these actors and use cases depict a holistic overview of the game development process, illustrating the seamless flow of interactions from installation to gameplay and development tasks.
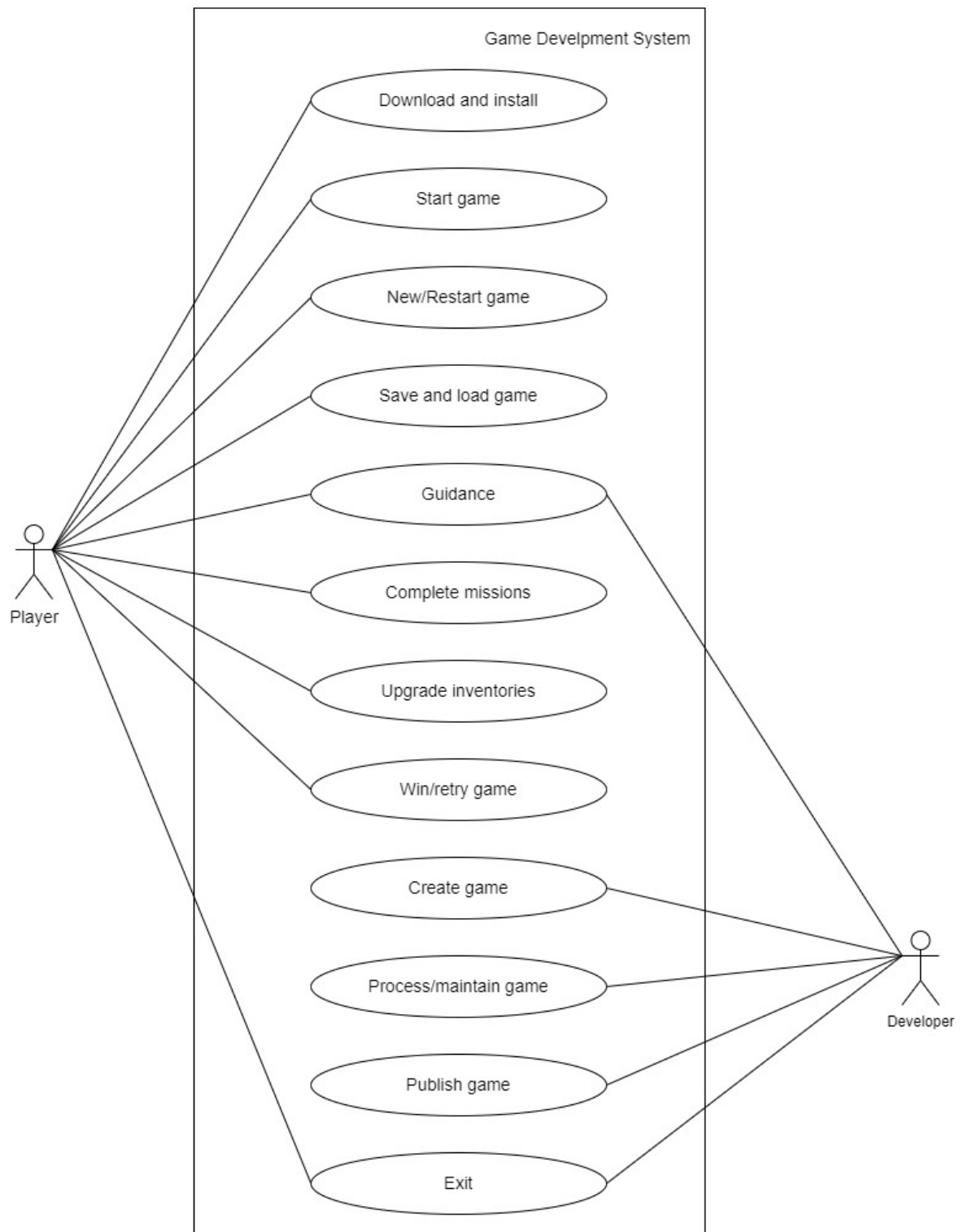
Figure 5.1: Use case diagram

5.2 Activity Diagram

An activity diagram for game development serves as a comprehensive visual representation of the intricate workflow and sequential activities involved in the creation of a game. The diagram starts with the 'Start' node, symbolizing the initiation of the game development process in Figure 5.2. From there, it unfolds into the primary activity of 'Game Creation,' which acts as a container for various sub-activities crucial to the development pipeline.

The first sub-activity, 'Conceptualization,' involves brainstorming and ideation to define the game's core concept, theme, and mechanics. This naturally leads to the 'Design' phase, where aspects such as gameplay mechanics, levels, and overall aesthetics are outlined. Simultaneously, the 'Programming' activity kicks off, illustrating the parallel execution of technical development alongside the conceptual and design phases.

The subsequent sub-activities include 'Art and Animation,' emphasizing the collaborative efforts between artists and developers to create the visual elements of the game. 'Sound Design' highlights the importance of audio in enhancing the gaming experience. These activities occur concurrently, illustrating the interdisciplinary nature of game development.

As the development progresses, the diagram incorporates post-production activities such as 'Testing' and 'Debugging.' The decision nodes 'Successful?' and 'Publishable?' represent critical evaluation points. If the game passes the criteria for success and publishability, the process proceeds to 'Publishing' and 'Release.' However, if adjustments are required, the diagram allows for looping back to refine specific elements, emphasizing the iterative nature of game development.

The 'End' node signifies the culmination of the game development activity, indicating that the game is ready for release. Overall, the activity diagram provides a holistic and structured view of the game development lifecycle, showcasing the collaborative efforts and sequential processes involved in transforming a game concept into a fully realized, polished product ready for the gaming audience.
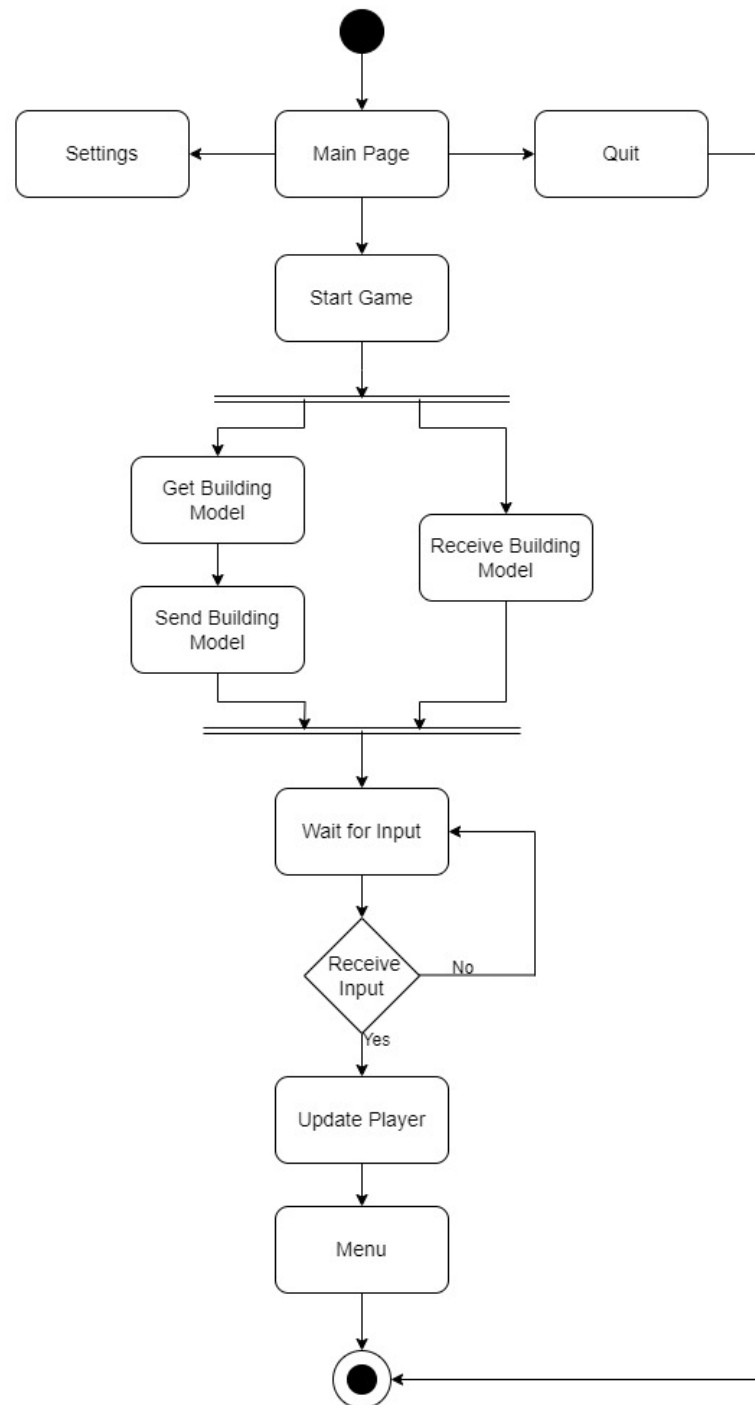
Figure 5.2: Activity diagram

5.3   Sequence Diagram

A sequence diagram is a powerful tool in software development that visually represents the interactions between different components or objects within a system over a specific period. It offers a chronological view of how messages are passed among various entities, providing developers with a clear blueprint of the system's behavior during different scenarios. In the context of our real-time action game, a sequence diagram becomes indispensable for illustrating the dynamic flow of interactions among key components: Player, Controller, Game, Graphic Engine, Sound Engine, Asset Manager, and Level Designer in Figure 5.3.

The Player initiates the sequence by interacting with the Controller, triggering instantaneous input signals. The Controller efficiently relays these commands to the Game module, which, in turn, processes them in real-time. The Game dynamically interacts with the Graphic Engine to ensure swift updates of the game's visual elements, maintaining a seamless and responsive user interface. Simultaneously, the Game communicates with the Sound Engine, triggering audio cues and sound effects precisely aligned with in-game events, enhancing the immersive experience. The Asset Manager plays a critical role in our real-time architecture. It dynamically loads and manages game assets on-the-fly, preventing any noticeable delays during gameplay. The Level Designer contributes to the real-time environment by providing dynamic data on the game's structure, influencing gameplay scenarios as the Player progresses. Any malfunction in these components can significantly impact the real-time nature of our game. A glitch in the Graphic Engine might result in lag or visual artifacts, compromising the user experience. Issues with the Sound Engine could lead to inconsistencies in audio feedback, disrupting the immersive feel of the game. A breakdown in the Asset Manager may cause delays or missing assets, adversely affecting the flow of gameplay.
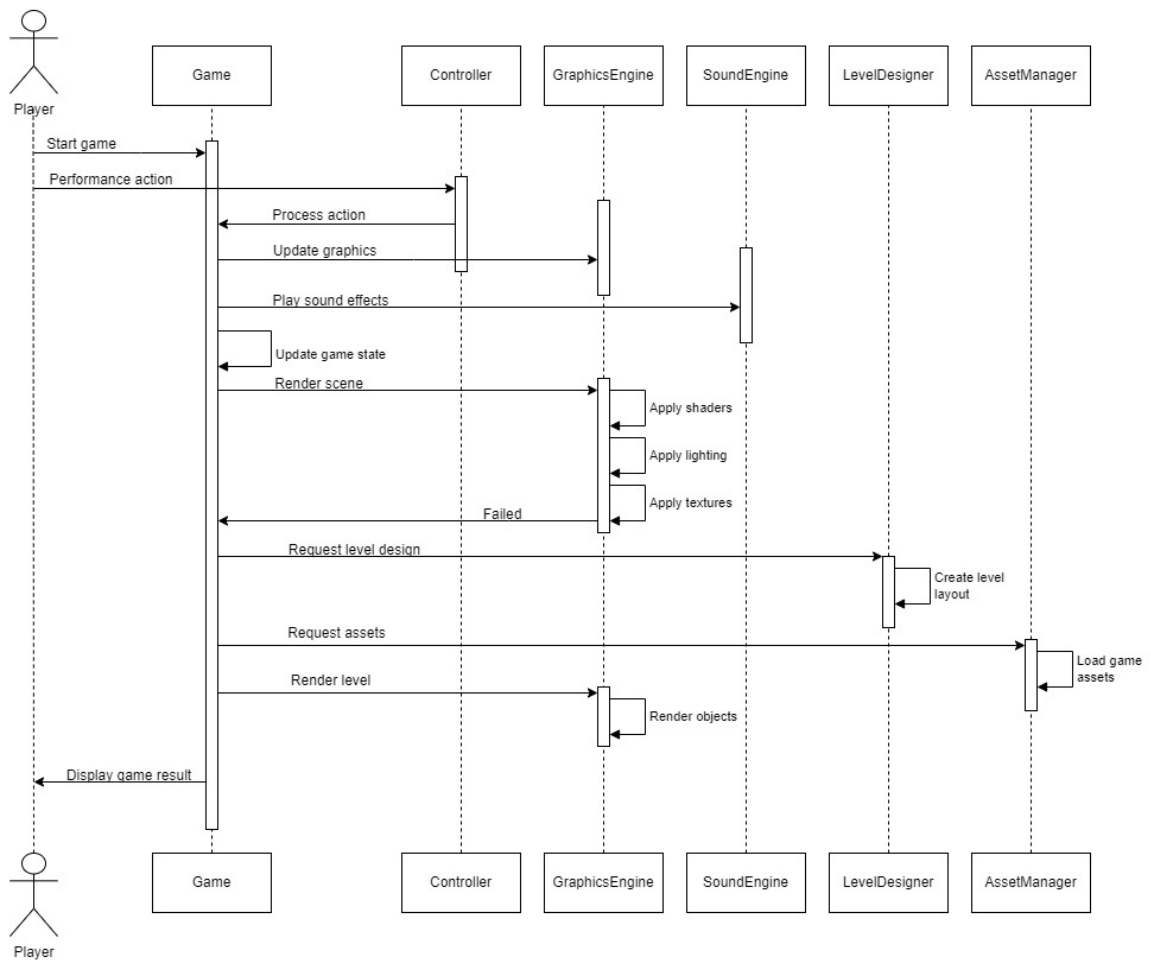
Figure 5.3: Sequence diagram

Conclusion

In the realm of collage creation, Galerius emerges as a project that harmoniously aligns with artistic objectives. With a dedication to providing visual delight through a captivating composition, Galerius embraces innovative and imaginative concepts, pushing the boundaries of artistic expression to craft a visually striking and thematically resonant representation of ancient Rome. The project places a premium on evocative storytelling, nurturing a connection with viewers through intricate visual narratives and meticulous attention to historical accuracy. Adapting to the dynamic realm of visual arts, Galerius understands the significance of artistic excellence, community collaboration, and viewer engagement, aspiring to transcend the confines of traditional collage creation by evolving into a dynamic and communal experience. The project spans across diverse artistic mediums, employs a multidisciplinary approach, and places emphasis on visual and thematic elements to enrich the overall artistic experience. Thorough review, artistic refinement, and post-showcase support further underscore Galerius' commitment to delivering a refined and enduring artistic journey that captivates viewers and stands out in the expansive landscape of the artistic realm.

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VISION & MISSION OF THE DEPARTMENT

Vision

To evolve as a school of computing with globally reputed Centre's of excellence and serve the changing needs of the industry and society.

Mission

- The department is committed in bringing out career-oriented graduates who are industry ready through innovative practices of teaching and learning process

- To nurture professional approach, leadership qualities and moral values to the graduates by organizing various programs periodically

- To acquire self-sustainability and serve the society through research and consultancy